Kidney infections

Acute pyelonephritis

Inflammation of renal parenchyma and renal pelvis

Typically fever, chills and costovertebral angle tenderness +/- LUTS

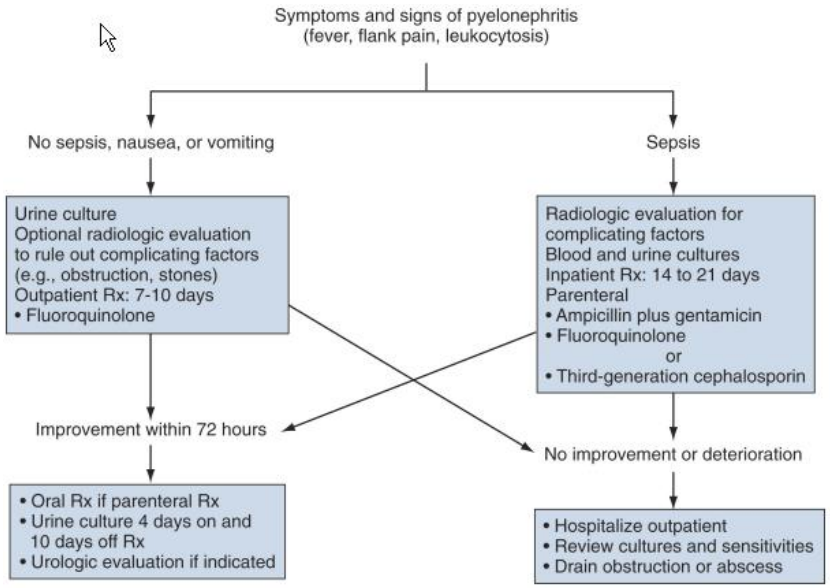
Gram negative bacteria

- **E. coli***
- Proteus
- Klebsiella
- Pseudomonas
- Enterobacter
- Citrobacter
- Serratia
- Enterococcus, S aureus and S epidermidis occasional GP orgs.

*E. coli expressing Type II p-fibriae responsible for 80% of cases

Diagnosis

- Urinalysis typically positive for nitrities and leucocytes
- MSU > 10^4 cfu/ml with pyuria suggestive (?arbitrary definition) – 20% have counts less than 10^5
- WBC casts
- Elevated CRP and ESR
- Imaging
  - Not indicated in acute uncomplicated pyelonephritis
  - Reserved for complicated cases or those not responding after 72 hrs
  - IVU Renal enlargement in 20% if done acutely – may be focal (lobar nephronia) appearing as a mass lesion
    Reduced nephrogram and delay secondary to cortical vasoconstriction
  - USS Excludes obstruction, identifies stones and gross focal changes
  - CT Excellent for focal changes and identification of gas and stones. Generally reserved for those failing to improve.



Management

Mild, outpatient

PO TMP-SMX 14 days
*PO Ciprofloxacin 500mg bd 7 days
7 day course of cipro more effective and fewer side effects than 14 day course of TMP-SMX (Talan 2000).
Third generation cephalosporin cefpodoxime proxetil 200mg bid equivalent efficacy cf. ciprofloxacin 500mg bid.
No adequately powered studies of penicillin/BLI vs. fluoroquinolone or TMP-SMX

Table 2.4: Oral treatment options of acute uncomplicated pyelonephritis in adult pre-menopausal non-pregnant women according to level of evidence and grade of recommendation. (For parenteral therapy, see text.)

Substance	Dosage	Duration	LE	GR	Author, year	Ref	Remarks
Ciprofloxacin	500 mg bid	7 days	Ib	A	Talan 2000	69	a) Ciprofloxacin significantly more effective than cetriaxone/TMP-SMX and with trend towards less AE
CiproXR	1000 mg od	7-10 days	Ib	A	Talan 2004	70	b) Efficacy and tolerance of extended release ciprofloxacin (ciproXR) 1000 mg od equivalent with 10-day conventional ciprofloxacin
Cefpodoxime*	200 mg bid	10 days	Ib	B	Naber 2001	73	c) Clinically equivalent with ciprofloxacin 500 mg bid
Gatifloxacin	400 mg od	10 days	Ib	A	Naber 2004	71	d) Equivalent with ciprofloxacin 500 mg bid, not available in Europe
Levofloxacin	250 mg od	10 days	Ib	A	Richard 1998	72	e) Equivalent with ciprofloxacin 500 mg bid
Lomefloxacin	400 mg od	10 days	Ib	B	Richard 1998	72	f) Study statistically underpowered
TMP-SMX	160/800 mg bid	14 days	Ib	B	Stamm 1987 Talan 2004	68 70	g) Only if uropathogen is known to be susceptible to TMP

*Cefpodoxime proxetil.
LE = level of evidence; GR = grade of recommendation; TMP = trimethoprim; SMX = sulphamethoxazole; tid = three times daily; bid = twice daily; od = once daily; AE = adverse events.

Mod/severe, I/P

IVI, IVABx, antiemetics, painkillers 14-21days
IV Gent and ampicillin (7mg/kg; 1g qds)
IV Ceftriaxone 1-2g qds
IV Ciprofloxacin 400mg bd

Pregnant

IV Ceftriaxone 1-2g qds
IV Gent and ampicillin
IV Tazocin 4.5mg tds
IV Imipenem 500mg qds

Imaging for complicating factors
10-30% relapse rate after 14 days appropriate Rx – repeat MSU 4 days on and 10 days off Rx. Usually cured after further 2 week course.

Acute focal bacterial nephritis

Uncommon form of acute pyelonephritis
Similar presentation but more unwell
Often in diabetics and immunocompromised
Mass on USS
Wedge shaped area of poor perfusion on contrast enhanced scan
Management as for acute pyelonephritis

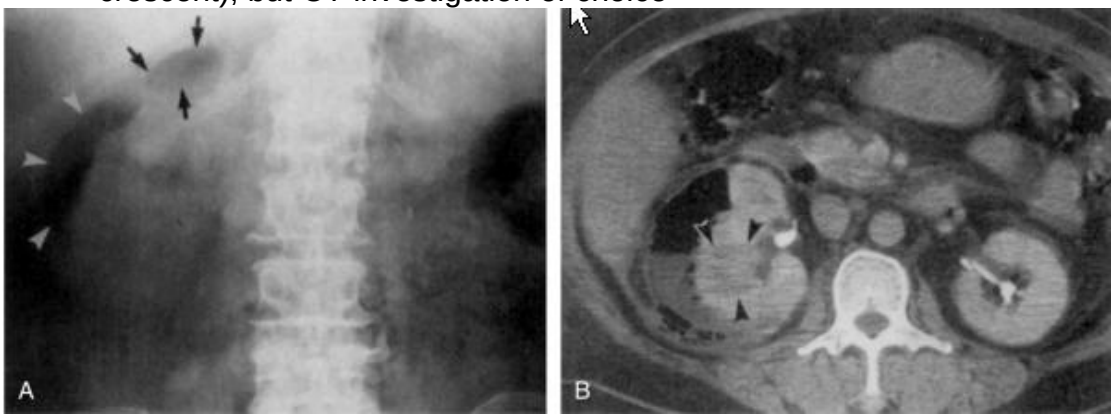
Emphysematous pyelonephritis

Rare severe necrotising infection of kidney; a/w mortality rates of 20-43%
Usually in diabetics (70-90%), always in adults, often with a history of UUT obstruction
Classic triad of fever, loin pain and vomiting always seen; 50% palpable mass, occasionally with crepitation

E Coli is usually responsible – produces carbon dioxide from metabolism of sugars

Diagnosis

AXR shows gas in renal parenchyma in 85% cases (mottled vs. crescent), but CT investigation of choice



Classification

Divided into type 1 and type 2 based on CT findings:

Type 1
- Generalised renal infection
- Gross parenchymal destruction
- Small gas locules throughout kidney
- Minimal fluid collection
- ~60% mortality

Type 2
- Localised renal infection
- Mild/moderate focal destruction
- Coalescence of gas focally
- Air-fluid level
- ~20% mortality

Management

- Resuscitation
- Broad spectrum antibiotics
- IV insulin sliding scale
- Emergent nephrectomy (medical therapy alone a/w 60-80% mortality)

<u>Renal abscess</u>

Pus in the renal parenchyma

Organisms

(i) Gram-negative
- Most common
- Almost universally from ascending route
- Two-thirds in association with stones or renal damage; occasionally a/w reflux disease
- Experimental and clinical data suggest haematogenous seeding by GNB rare, except in instances of complete collecting system obstruction

(ii) Gram-positive
- Uncommon

Historically majority of renal abscesses were secondary to haematogenous seeding by staphylococci. Now rare, except for immunocompromised and IVDU

(iii) Mycobacteria

Very rare even in patients with genitourinary TB
Usually parenchymal scarring, wall thickening and calcification, hydronephrosis and hydrocalcycosis
Isolated hydrocalycosis may be mistaken for renal abscess however

Clinical features:

Fever, chills, rigor
Malaise and lethargy
Abdominal/flank pain
Leucocytosis
Positive UTI (GNB only)

Diagnosis:

USS

Initially indistinct echopoor parenchymal SOL with varying degree of internal echoes
maturation into discreet lesion of variable echotexture with hyperechoic margin
Presence of air casts dense echo/shadow

CT

Renal enlargement
Discreet low attenuation mass with surrounding rim of higher attenuation (ring-sign)

Management:

Dependent on size
Small abscesses <= 3cm a/w resolution with prompt administration of appropriate ABx
Abscesses > 3cm suitable for percutaneous drainage.
Failure to respond to above should prompt a search for perinephric abscess
Surgery may be considered as primary surgery for abscesses > 5cm

<u>Infected hydronephrosis/pyonephrosis</u>

Definitions below from Campbells
Infected hydronephrosis – bacterial infection in hydronephrotic kidney
Pyonephrosis – infected hydronephrosis with suppurative destruction of renal parenchyma a/w total or near total loss of renal function
Clinical presentation: severe sepsis, with fever, chills, rigors, abdominal pain, shock, leucocytosis. Dipstick may be negative in complete obstruction
USS diagnosis of pyonephrosis dependent upon identification of internal echoes in dependent portion of kidney. Focal echopoor areas within parenchyma suggest destruction highly suggestive of pyonephrosis vs. infected hydronephrosis.

Management:

Antimicrobials and judicious drainage
Percutaneous vs. endoscopic drainage

Perinephric abscess

Pus within Gerota's fascia [cf. paranephric abscess = outside Gerota's fascia]

Routes of infection:

- Kidney (60-80%)
  - ruptured cortical abscess (Staphylococcal seeding)
  - ruptured corticomedullary abscess (GNB)
  - ruptured calyx
    - pyonephrosis
    - calyceal diverticulum
    - staghorn
- Haematogenous (10-30%)
  - Skin, mouth, lung infections
  - Infected perinephric haematoma
- Paranephric space (10%)
  - Bowel (Crohns etc.)
  - Pancreas
  - Subphrenic/subhepatic abscess
  - Spine (Pott's etc.)

Clinical presentation

- Insidious development of symptoms – 60% present > 14 days
- Unexplained fever (absent in ~30%)
- Nightsweats
- Weight loss
- Antalgic gait, flexion and enternal rotation with psoas iritation
- Leucocytosis and pyuria in >75% cases
- Multiple organisms = MSU and blood culture frequently miss organisms
- Edelstein 1988 (therefore broad spectrum irrespective of results)

Diagnosis

- AXR
  - Normal in 40%
  - Loss of renal outline and/or psoas shadow
  - Scoliois in up to 50%
  - Rarely gas or air/fluid levels
- USS
  - Generally hypoechoic with debris (occasionally air)
  - Hyperechoic thick, irregular wall
- CT
  - Investigation of choice

Management

(i) Appropriate antibiotics [NB. a number of reviews have shown that virtually all patients with acute pyelonephritis are rendered afebrile with 4 days of appropriate IV antibiotics (Thorley 1974, Fowler 1994) – thus if patient continues to spike after 4 days needs CT to exclude parenchymal or perinephric abscess]

(ii) Drainage (percutaneous or surgical)

Xanthogranulomatous pyelonephritis

Destruction of renal parenchyma with granulomatous infiltrates containing lipid-laden macrophages

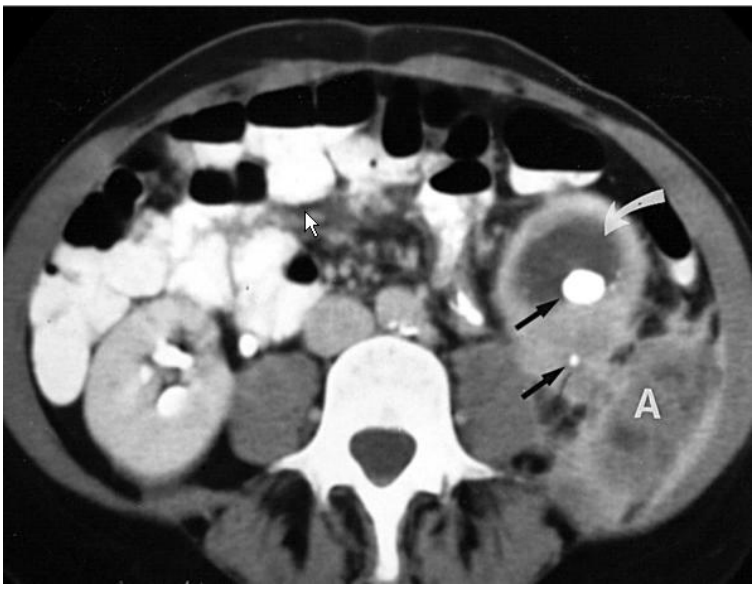
Rare

Women > men

Adults > children

Peak incidence 40-60 yrs

- Aetiology
  - Unknown
  - Nephrolithiasis in ~80%
  - Upper tract obstruction +/- stones in others (PUJO, VUR)
  - Increased risk in diabetes and immunocompromised
- Presentation
  - Fever
  - Flank pain
  - Weight loss
  - Palpable mass
  - Occasionally fistula
- Pathology
  - Macro
    - Hugely enlarged kidney with normal contour typical – occasionally focal
    - Lesion starts in PC system and invades into renal parenchyma
  - Micro
    - Lipid-laden (foamy) macrophages (difficult to distinguish from CCRCC on microscopy, and especially difficult on frozen section)
    - Visible bacteria
- Diagnosis
  - Blood investigations as for pyelonephritis
  - Positive urine cultures in 50-75%
    - Proteus > E. Coli
  - Positive renal tissue culture in >90%
  - Radiology
    - Classic triad in >50%
      - **Unilateral renal enlargement**
      - **Non-function**
      - **Calculus**
    - USS Hypoechoic centre and hyperechoic rim
    - CT Investigation of choice
      - Enlarged kidney with normal contour
      - Water-density central lesion (often with stone at centre) surrounded by enhancing rim (differs from RCC)



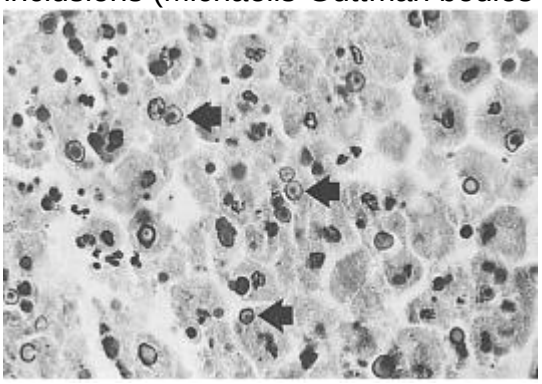
Management
- Nephrectomy Rx of choice
  - Establishes diagnosis
  - Kidney often non-functioning
  - Removes infective focus
- Antibiotics should be commenced ASAP and continued peri-operatively
- Partial nephrectomy may be an option for localised disease
- Conservative Mx reported but excluding malignancy difficult on Bx alone

Malakoplakia
= 'Soft plaque'
Originally described by Michaelis and Guttman in 1902
Chronic inflammatory condition affecting urinary tract believed to represent abnormal response to infection
Characterised by presence of lipid laden (foamy) macrophages containing pathognomonic Michaelis-Guttman bodies
Urinary tract involved in ~60% of cases (GIT, lung, skin and LNs also may be affected)
Rare
Female > males 4:1
Age > 50 yrs
Aetiology
- Unknown
- Coliform UTI (usually E. Coli) a consistent finding on MSU
- ~ 50% immunosuppressed or serious sytemic disease
- Believed to represent a failure of macrophages to adequately phagocytose bacteria
- Macrophages have reduced cGMP and increased alpha-1 antitrypsin

Presentation
- Usually patient has a history of recurrent coliform UTIs
- Bladder irritative LUTS and haematuria
- Ureter obstruction and haematuria

Kidney flank pain fever and mass
Abnormal mass on imaging
Rarely a/w renal vein thrombosis

Pathology
Soft yellow-brown plaques
Grow to form polypoid lesions
Micro Large histiocytes (vonHansellmann cells) containing basophilic inclusions (Michaelis-Guttman bodies – arrowed.



Diagnosis
Biopsy confirms diagnosis
Occasionally early disease a/w absence of MG bodies
IHC of histiocytes highly positive for alpha-1 AT which suggests diagnosis

Management
Chronic antibacterial prophylaxis
Rifampicin, doxyclycline and TMP especially good as have intracellular activity
Nephrectomy for symptomatic unilateral lesions
Overall mortality 15% (~20% for renal disease)

<u>Chronic pyelonephritis</u>
Common
25% of ESRF population
Aetiology controversial. Some believe that untreated chronic infection – vasoconstriction (TXA2) – ischaemia – atrophy, but most believe that chronic infection alone is not sufficient to damage renal parenchyma.
Damage may have occured in childhood with reflux of infected urine into kidney
Histology shows non-specific infiltrate of lymphocytes, plasma cells and occasionally PMNs.
Management – renal support and treatment of UTIs

<u>Renal echinnococcus</u>
Extremely rare
Larva from dog tapeworm – human gut – duodenum penetration – liver – lungs. 3% pass through lungs to systemic circulation to kidneys
Typical renal hydatid cysts
Single in 95% of cases; bilateral in 5%
Slow growth – 1cm/yr

- Triple epthelium – outer fibroblasts, middle capsule layer, inner germinal layer (producing more larva known as scoleces in daughter cysts) Daughter cysts detach from germinal layer to float freely within main cyst
- Vague back pain, mass and haematuria
- Predilection for seeding in renal poles

Diagnosis

- <50% eosinophilia
- Immunology variously reliable
- Daughter cysts in urine diagnostic but usually not present

Management

- Surgical
  - Avoid rupture – risk of anaphylaxis
  - Pretreat with mebendazole/albendazole
  - ? inject scolicidal agent prior to removal
- Mebendazole/albendazole unreliable as medical Rx alone